

# Study on the Relationship between General Health and Oral Health According to Diabetes

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## Abstract

**Background/Objectives:** In this study, the relation between the health level and oral health in middle aged according to the diabetes were examined.

**Method/Statistical Analysis:** For this study, raw data were requested to Korea Centers for Disease Control and Prevention and among them, the data for 3,049 citizens in D Metropolitan City were analyzed. The statistical software R program was used for the analysis.

**Findings:** In the results of performing multiple logistic regression analysis taking the diabetes as dependent variable, the cases having the chronic disease, dyslipidemia, arthritis, and inconvenient mastication and the case that they did not brushing the tooth after breakfast and before sleep were shown significantly high ( $p < 0.05$ ).

**Improvements/Applications:** This study was intended to verify the needs of prevention for the efficient oral health management in patients with diabetes and to be utilized as basic data to develop the product for oral health improvement in the patients with diabetes.

**Keywords:** *Diabetes, Chronic disease, Health, Oral Health, Happiness Index.*

## Introduction

Diabetes is the chronic disease that the glucose is increased by the lack of insulin, and secondarily, the complications such as retinopathy, renal disorder, stroke, angina, myocardial infarction, oral diseases, etc. are caused. The complications of diabetes appear in various forms as a result that various metabolic disorders are caused. Among them, as a 6th complication of diabetes, the periodontal disease has been reported<sup>[1-2]</sup>. The intra-oral symptoms that appear in the patient with diabetes are periodontal disease, dental caries, xerostomia, tooth

loss, gingivitis, cheilitis, burning sensation of soft tissue, etc.<sup>[3]</sup>, and particularly, it has been reported that since the patient with diabetes has higher glucose concentration in saliva than normal person, dental caries appears more<sup>[4]</sup>. In addition, it has been reported that Decayed Missing Filled Teeth Index (MDFT index), which shows the objective oral health condition, is measured high in the patient with diabetes than the normal person, and the longer the period of illness, the higher the tooth loss index is<sup>[5]</sup>. Out of the oral characteristics of diabetes, the periodontal disease is the representative chronic disease and mostly cause the destruction of periodontal tissues in the adults such as gingival bleeding, gingival recession, periodontal pocket formation, destruction of alveolar bone, etc. and in severe case, cause teeth loss<sup>[6]</sup>. Periodontal diseases appear associated with diverse diseases like specific systematic diseases or metabolic syndrome<sup>[7]</sup>, particularly, in case of diabetes, it has trend that the periodontal diseases are serious<sup>[8]</sup>, and the prevalence of gingivitis and periodontal disease in

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the patient with diabetes is higher than in the normal person. The research results on the quality of life related oral health also reported that the better the diabetes is managed, higher the quality of life and the mental health problem in the patient with diabetes such as depression, etc. is high than in the normal person<sup>[9]</sup>. In the research on the quality of life related to oral health, most of the responders answered that the oral health has important effect on the quality of life and there is a research results that reported that the improvement of oral health has positive effect on the quality of life<sup>[10-11]</sup>. Currently the awareness on the association of diabetes, chronic diseases with oral health and the importance of oral health is being increased. However, the awareness of oral diseases management is still low for the reason that it does not affect life. Therefore, this study examined the association of the systemic health with the oral health according to diabetes, through which it confirms the needs to prevent the oral disease for the efficient oral health management in the patient with diabetes and provides the basic data to develop the products for oral health improvement in the patient with diabetes.

### Method

For this study, raw data of the 2015 Community Health Survey were requested to Korea Centers for Disease Control and Prevention and among them, the data for 3,049 citizens in D Metropolitan City were analyzed. For the analysis, the statistical software R program was used and the significance level was 0.05.

For the general characteristics and healthy lifestyle practice variables, the frequency analysis and chi-square test were performed for the age, education level, marital status, household income, current smoking habit, lifelong drinking habit, medium level of physical activity practice according to the gender. Chi-square test was performed for the chronic disease and subjective health level, happiness index, oral health and the level of oral health practice. Multiple logistic regression analysis was performed for the chronic disease, oral health and level of oral health practice taking the diabetes as dependent variable.

### Result and Discussion

**1. General characteristics of the subjects:** In the results of analyzing the general characteristics according to gender, in the education level, the women graduated the elementary school were

72.4%, the highest ( $p < 0.001$ ). In the marital status, the divorced, widow, separated women were 74.2%, the highest and followed by the single man, the women having spouse, etc in order ( $p < 0.001$ ). In the household income, the women from 500,000 to 1,000,000 won were 63.4%, the highest and followed by women from 1,000,000 to 3,000,000 won and women more than 5,000,000 won ( $p < 0.05$ ). In the current smoking habit, 89.4% of the men had smoking habit and 64.1% of the women did not have smoking habit ( $p < 0.05$ ). In the lifelong drinking habit, 80.1% of the women did not have drinking habit and 50.5% of the men had drinking habit ( $p < 0.05$ ). In the medium level of physical activity practice, 59.2% of the women did not engage in physical activity ( $p < 0.05$ ) [Table 1].

**2. Chronic Disease, Subjective Health level and Happiness Index according to Diabetes:** In the group without having diabetes, the case that did not have hypertension was 92.2%, significantly high and in the group having diabetes the prevalence of hypertension was 25.8% ( $p < 0.05$ ). For the dyslipidemia, in the group without having diabetes, the case that did not have dyslipidemia was 90.3%, significantly high and in the group having diabetes. The prevalence of dyslipidemia was 26.99%. For the arthritis, in the group without having diabetes, the case that did not have arthritis was 88.6%, significantly high, and in the group having diabetes, the prevalence of arthritis was 22.4% ( $p < 0.05$ ). For the asthma, in the group without having diabetes, the case that did not have asthma was 87.8%, significantly high, and in the group having diabetes, the prevalence of asthma was 22.0% ( $p < 0.05$ ). For the depression, in the group without having diabetes, the case that did not have depression was 87.2%, significantly high, and in the group having diabetes, the prevalence of depression was 23.5% ( $p < 0.001$ ). For the subjective health level, in the group without having diabetes, the case that the subject health level is good was 94.5%, significantly high, and in the group having diabetes, the case that the subjective health level is 'poor' was 26.8% ( $p < 0.05$ ). For the happiness index, the case that did not have diabetes was  $6.99 \pm 4.711$ , high. Generally, in case that did not have diabetes, the chronic diseases appeared low and the subjective health level and happiness index were high [Table 2].

**Table 1. General characteristics of study subjects**

Variable	Categories	Male		Female		Total		p-value
			%		%		%	
<b>Age</b>								
	40 -59	838	45.2	1,016	54.8	1,854	60.8	0.959
	60 or older	539	45.1	656	54.9	1,195	39.2	
<b>Education Level<sup>1</sup></b>								
	Elementary school	186	27.6	488	72.4	674	22.2	0.000
	Middle school	157	45.8	186	54.2	343	11.3	
	High school,	417	42.2	570	57.8	987	32.5	
	College or higher	609	59.1	422	40.9	1,031	34.0	
<b>Marital Status</b>								
	Single	55	65.5	29	34.5	84	2.8	0.000
	Has spouse	1,164	49.3	1,198	50.7	2,362	77.5	
	Divorced, Widow, Separated	155	25.8	445	74.2	600	19.7	
<b>Household Income</b>								
	0.5-1 million won	183	36.6	317	63.4	500	16.4	0.000
	1-3 million won	467	45.6	558	54.4	1,025	33.6	
	3-5 million won	428	47.7	470	52.3	898	29.5	
	5 million or more	299	47.8	327	52.2	626	20.5	
<b>Currently Smoking</b>								
	Yes	473	89.4	56	10.6	529	17.3	0.000
	No	904	35.9	1616	64.1	2,520	82.7	
<b>Lifelong Drinking</b>								
	Yes	1,271	50.5	1,244	49.5	2,515	82.5	0.000
	No	106	19.9	428	80.1	534	17.5	
<b>Medium Level of Physical Activity Practice<sup>2</sup></b>								
	Yes	556	53.6	481	46.4	1,037	34.0	0.000
	No	821	40.8	1,189	59.2	2,010	66.0	
<b>Total</b>		<b>838</b>	<b>45.2</b>	<b>1,016</b>	<b>54.8</b>	<b>3,049</b>	<b>100.0</b>	

1. Education Level : Include graduates of relevant educational institution or higher those who are studying, , completed, dropout and leave of absence

2. Practice rate of medium level of physical activity: (Number of persons who practiced the medium level of physical activity more than 30 minutes a day for more than 5 days a week / Number of subject) ×100

\* p-value calculated by  $\chi^2$ -test

**3. Oral Health and Oral Health Practice Level according to Diabetes:** In the subjective health level according to diabetes, in the group without having diabetes, the case that responded 'Good' was 90.7%, the highest, and in the group having diabetes, the case that responded 'Good' was 9.3%, the lowest ( $p<0.05$ ). For the level of experiencing the inconvenient mastication, the case that responded 'Not inconvenient' was 90.1%, the highest ( $p<0.05$ ) and for the annual oral health examination, those who responded to receive examination was 88.6%, the highest ( $p<0.05$ ). The annual scaling experience

was 89.3%, significantly high ( $p<0.05$ ) and for the subjective periodontal tissue health level, 89.8% responded 'Significantly good' ( $p<0.05$ ). In case of the group having diabetes, since those who responded 'Yes' for the toothbrushing after breakfast was 9.2%, low ( $p<0.05$ ), those who responded 'Yes' for the toothbrushing after lunch was 11.7% ( $p<0.05$ ), low and those who responded 'Yes' for the toothbrushing before sleep was 10.0%, low, in case of the group having diabetes, the toothbrushing after meal was not managed well ( $p<0.05$ ) [Table 3].

**Table 2. Chronic Disease, Subjective Health level and Happiness Index according to Diabetes**

Variable	Categories	Diabetes Diagnosis				Total		p-value
		Yes (n=400)		No (n=2,649)				
			%		%		%	
<b>Hypertension</b>								
	Yes	231	25.8	664	74.2	895	29.4	0.000
	No	169	7.8	1,985	92.2	2,154	70.6	
<b>Dyslipidemia</b>								
	Yes	161	26.9	438	73.1	599	19.7	0.000
	No	238	9.7	2,210	90.3	2,448	80.3	
<b>Arthritis</b>								
	Yes	108	22.4	375	77.6	483	15.8	0.000
	No	292	11.4	2,274	88.6	2,566	84.2	
<b>Asthma</b>								
	Yes	20	22.0	71	78.0	91	3.0	0.011
	No	380	12.8	2,578	87.2	2,958	97.0	
<b>Depression</b>								
	Yes	59	23.5	192	76.5	251	8.2	0.000
	No	341	12.2	2,457	87.8	2,798	91.8	
<b>Subjective Health Level</b>								
	Good,	62	5.5	1,075	94.5	1,137	37.3	0.000
	Fair	160	12.8	1,088	87.2	1,248	40.9	
	Poor	178	26	486	73.2	664	21.%	
<b>Happiness Index (Mean±SD)</b>								
		6.60 ± 6.125		6.99 ± 4.711		6.80 ± 5.418		0.142
<b>Total</b>		400	13.1	2,649	86.9	3,049	100	

\* p-value calculated by  $\chi^2$ -test

**4. Multiple Logistic Regression Analysis on Chronic Diseases according to Diabetes:** In the group having diabetes, the case having hypertension was 3.117 times higher than the case without having hypertension ( $p < 0.05$ ), the case having dyslipidemia was 2.320 times higher than the case without having dyslipidemia and the case having arthritis was 1.328 time than the case having arthritis ( $p < 0.05$ ) [Table 4].

**5. Multiple Logistic Regression Analysis on Oral Health according to Diabetes:** In the group having diabetes, the case that had inconvenient toothbrushing was 2.119 times higher than the case that did not ( $p < 0.05$ ), the case that brushed tooth after breakfast was 0.627 times ( $p < 0.001$ ) the case that did not, and the case that brushed tooth before sleep was 1.591 times higher than the case that did not ( $p < 0.05$ ) [Table 5].

**Table 3. Oral Health and Oral Health Practice Level according to Diabetes**

Variable	Categories	Diabetes Diagnosis				Total		p-value
		Yes (n=400)		No (n=2,649)				
			%		%		%	
<b>Subjective Oral Health</b>								
	Good,	66	9.3	644	90.7	710	23.3	0.000
	Fair	109	9.5	1,036	90.5	1,145	37.6	
	Poor	225	18.8	969	81.2	1,194	39.2	

Variable	Categories	Diabetes Diagnosis				Total		p-value
		Yes (n=400)		No (n=2,649)				
			%		%		%	
<b>Inconvenient Mastication Experience</b>								
	Inconvenient	146	21.8	523	78.2	669	21.9	0.000
	Fair	57	14.4	339	85.6	396	13.0	
	Not Inconvenient	197	9.9	1,787	90.1	1,984	65.1	
<b>Annual Oral Health Examination</b>								
	Yes	160	11.4	1,240	88.6	1,400	45.9	0.011
	No	240	14.6	1,409	85.4	1,649	54.1	
<b>Annual Scaling Experience</b>								
	Yes	145	10.7	1,214	89.3	1,359	50.1	0.026
	No	182	13.5	1,170	86.5	1,352	49.9	
<b>Subjective Periodontal Tissue Health</b>								
	Good	187	10.2	1,638	89.8	1,825	67.4	0.000
	Poor	141	16.0	740	84.0	881	32.6	
<b>Toothbrushing after Breakfast</b>								
	Yes	359	13.8	2,243	86.2	2,602	85.4	0.008
	No	41	9.2	405	90.8	446	14.6	
<b>Toothbrushing after Lunch</b>								
	Yes	216	11.7	1,638	88.3	1,854	60.8	0.003
	No	184	15.4	1,009	84.6	1,193	39.2	
<b>Toothbrushing after Sleep</b>								
	Yes	139	10.0	1,252	90.0	1,391	45.6	0.000
	No	261	15.8	1,396	84.2	1,657	54.4	
<b>Total</b>		<b>400</b>	<b>13.1</b>	<b>2,649</b>	<b>86.9</b>	<b>3,049</b>	<b>100</b>	

\* p-value calculated by  $\chi^2$ -test

**Table 4. Multiple Logistic Regression Analysis on Chronic Diseases according to Diabetes**

	B	S.E.	Wald	df	Sig. Level	Exp(B)	95% of EXP(B) C.I.	
							Lower Limit	Upper Limit
Hypertension (Yes)	1.137	.117	93.955	1	.000	3.117	2.477	3.922
Dyslipidemia (Yes)	.841	.123	46.548	1	.000	2.320	1.822	2.954
Arthritis (Yes)	.284	.138	4.245	1	.039	1.328	1.014	1.741
Asthma (Yes)	.158	.279	.322	1	.570	1.171	.678	2.022
Depression (Yes)	.555	.170	10.662	1	.001	1.742	1.248	2.430
Constant	-2.704	.089	929.586	1	.000	.067		

Reference group: Hypertension (No), Dyslipidemia (No), Arthritis (No), Asthma (No), Depression (No).

**Table 5. Multiple Logistic Regression Analysis on Oral Health according to Diabetes**

	B	S.E.	Wald	df	Sig. Level	Exp(B)	95% of EXP(B) C.I.	
							Lower Limit	Upper Limit
Inconvenient Mastication (Inconvenient)	.751	.151	24.863	1	.000	2.119	1.577	2.846
Inconvenient Mastication (Fair)	.302	.183	2.708	1	.100	1.352	.944	1.937
Annual Oral Health Examination (No)	.061	.132	.212	1	.645	1.062	.821	1.375
Annual Scaling Experience (No)	.080	.131	.368	1	.544	1.083	.837	1.401
Toothbrushing after Breakfast (No)	-.467	.196	5.683	1	.017	.627	.427	.920
Toothbrushing after Lunch (No)	.189	.129	2.166	1	.141	1.208	.939	1.555
Toothbrushing before Sleep (No)	.464	.136	11.571	1	.001	1.591	1.217	2.079
Constant	-2.676	.143	352.770	1	.000	.069		

Reference group: Subjective Periodontal Tissue Health Level (Good), Inconvenient Mastication (Not inconvenient), Annual Oral Health Examination (Yes), Annual Scaling Experience (Yes), Toothbrushing after Lunch (Yes), Toothbrushing before Sleep (Yes).

**Conclusion**

In case of group having diabetes, out of the chronic diseases, the hypertension, dyslipidemia, arthritis, asthma, depression were shown significantly high and the subjective health level was also shown poor (p<0.05). In case of the group having diabetes, since the subjective periodontal tissue health level was poor, the level of inconvenient mastication was inconvenient and the subjective oral health level was poor, it was observed that they had the oral health management problem. In the oral health practice level, it was shown that they did not receive the annual oral health examination or the scaling, and particularly, did not brush the tooth after breakfast and lunch and before sleep (p<0.05). In the results of performing multiple logistic regression analysis taking the diabetes as dependent variable, the cases having the chronic disease, dyslipidemia, arthritis, and inconvenient mastication and the case that they did not brushing the tooth after breakfast and before sleep were shown significantly high (p<0.05). In conclusion, for the oral health management in the patient with diabetes, diverse measures such as the management of complications of the chronic diseases, the development of systematic practice educational program related to oral health, etc. should be prepared at national level. Particularly, the strategic management measures for the single males of 60 years or older who have low income and low education level are needed desperately.

**Ethical Clearance:** Not required

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